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ABSTRACT

A perspective is presented for designing instruction in metacognition, drawing on how human beings acquire metacognitive skills and how these skills are interwoven with other thinking skills. An instructional designer must consider the dynamic and integrative nature of metacognition. Traditionally, learning theories, instructional theories, and instructional design theories are treated as distinct entities. Recent exploration of constructivism has made it seem possible to integrate learning and instructional theories. Learners, teachers, and instructional designers all need to engage themselves fully in the roles they play. Teachers need to guide, rather than control, student learning. Instructional designers must reflect on the complex relationship between learning and instruction. Learners need to be given the responsibility to direct, manage, or even design their own learning. The metacognition of teachers will enable them to perceive their instruction in a more reflective and dynamic way. Empowering teachers will empower learners. In a learning-centered environment, learners and teachers become the main actors of the learning drama. (Contains 26 references.) (SLD)

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Empowering Learners Through Metacognitive Thinking, Instruction, and Design

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EMPOWERING LEARNERS THROUGH METACOGNITIVE THINKING, INSTRUCTION AND DESIGN

by Ming-Fen Li

BACKGROUND

Since the enthusiasm for school restructuring swept the U.S., the role of learners has received increasing attention. Learners are no longer perceived as passive knowledge-consumers. What interests educators now is how to create a learning-centered environment to enhance learning achievement. With this increased awareness of the importance of learners, numerous proposals have been brought forward to restructure public education through technology, to empower teachers to redesign curricula and reorganize learning activities, to involve parents in extending learning beyond school, and to rearrange learning resources to narrow the gap between societal needs and school education. While much effort is expended to make learners the decision-makers of their own learning through the above approaches, I believe that the success of a learning-centered environment lies not merely in restructuring the environment external to the learners, but also in enabling learners to cultivate reflection upon their own learning.

Cognitive psychologists have identified the way one exercises mental processes as the most significant determinant in successful learning. Flavell (1978) coined the phrase "metacognition" for the way learners controlled and directed their own mental processes. Since then, metacognition has received more and more attention and has been applied in these contexts of learning. It is important to know how to present metacognition in various contexts of learning, instruction and design in order to enhance learners' mental capabilities and potential. Teaching students how to exercise their metacognition means kindling their intrinsic motivation and enabling them to assume the responsibility of learning, instead of overrelying on the teacher's external motivation.

STATEMENT OF THE PROBLEM

After Flavell coined the term metacognition in the early 1970s, there has been an increasing interest in exploring the essence of the concept and in constructing instructional models for promoting metacognitive learning. A great deal of research (Brown, Bransford, Ferrara, & Campione, 1983; Paris & Lindauer, 1982; Wellman, 1983; Paris, Wasik, & Vander Westhuizen, 1988; Pressley, Borkowski, & O'Sullivan, 1985) supports the importance of metacognition in cognitive development and academic learning, demonstrating that learners who are metacognitively active tend to perform better on cognitive tasks than those who are not, and that metacognition distinguishes an expert problem solver from a novice. Up to the present, research in metacognition covers several primary areas, such as the enhancement of disabled student learning, reading comprehension and monitoring, and problem solving. With successful application in these areas, the role of metacognition is becoming prominent. It has received more and more attention in both educational and training contexts, like the other higher-level thinking skills, such as critical thinking, problem-solving and inquiry (Leshin, Pollock &

Reigeluth, 1992).

Nevertheless, despite the fruitful findings in the literature, scholars do not agree on the definition of metacognition, defining it in various ways in the course of the past decades. This has caused a lot of confusion and remains a thorny problem to be solved. While the evolution of the diverse definitions of metacognition can be attributed to the new discoveries in learning psychology, and scholars' different use of it (Jones & Idols, 1990), there is a need to borrow new perspectives in order to come to a better and more comprehensive definition.

Current models of metacognitive instruction are predominantly developed for reading comprehension and science education. As learning tasks become more and more specialized in education and training, these models are inadequate to accommodate the wide varieties of content. Many instructional models on metacognition have simplified metacognitive instruction into a set of procedures, excluding many humanistic, social and cultural factors. Despite the various models of metacognitive instruction, there is a poverty of comprehensive information on how practitioners can design their own lessons by incorporating these models, since they are instructional models rather than instructional design models.

All of this calls for a close examination of the nature of metacognition and the way people teach it. Rather than teaching metacognition as a group of strategic skills encompassing the whole story of a learning task, I propose that the role of metacognition should be repositioned in a larger context of learning. It is imperative to provide guidance for practitioners on how to apply metacognitive instruction to a wider range of content, and design metacognitive instruction without sacrificing the knowledge of how people develop their metacognition, or neglecting the new ideologies and assumptions which underlie a specific learning task or content.

PURPOSE OF THE RESEARCH

The purpose of the research is to provide a set of perspectives for empowering learners through metacognitive thinking, instruction and design. These perspectives are based on a new conceptualization of metacognition and an integration of learning and instruction. Previous conceptions about metacognition are problematic since most of them place the emphasis on monitoring and learning strategies, neglecting the true nature of metacognition and the process by which learners acquire metacognitive skills. Current instructional theories have been overemphasizing the optimization of instruction, separating to a large extent design from instruction (Winn, 1989; Streible, 1991), making the enterprise of instructional design difficult to apply to many contexts. In addition, because of its focus on strategies acquisition, the existing design of metacognitive instruction is procedural-oriented, isolating metacognitive learning from creativity and other critical thinking skills. Therefore, this research will ground the design of metacognitive instruction more solidly on the nature of metacognitive learning.

CONCEPTUAL FRAMEWORK

The philosophical conceptual framework of the research will be the foundation of this research. This conceptual framework primarily comprises an investigation of the nature of human thinking and metacognition, the power of mental ability, the oneness of knowing and doing, and reflection upon the buried SELF in this highly technological and scientific world.

The lost horizon

Human beings have always been driven to innovate technology in order to improve life.

While enjoying the fruits of technology, and relying more and more on modern technology, they gradually neglect the inner self. The journey of metacognitive learning, instruction and design is to find that buried self and restore our full mental ability.

Power of mental thinking

A learning environment is usually easy to change if resources are available and technology is ready for it. However, the rearrangement of the learning environment does not always result in the reconstruction of one's mindset. When technology fails, we should look for the cause not in technology itself but rather in defects of human mental perspectives. Nevertheless, people still tend to be convinced by the power of technology, rather than that of their mental thinking. While educators align themselves with various endeavors in school reform, they should turn to the learners' internal world to explore its potential in order to enhance achievement.

Oneness of knowing and action

The power of inner thoughts lies in its determinant force of driving actions, especially actions for decision-making about learning and life. Back in the sixteenth century, a Chinese neo-Confucianist, Wang Yang-Ming (1472-1529), devoted most of his life to figuring out the inter-relationship between knowing and action. He first examined two premises: knowing is difficult and action is easy; action is difficult and knowing is easy. Then he proposed a theory that knowing is action, i.e. the oneness of knowing and action. In a similar manner, several scholars have recently called for situated or situational learning, claiming that learning is contingent upon doing, and only when learning is indexed in context can learners truly benefit from the knowledge (Brown, Collins, & Duguid, 1989). These scholars seemingly emphasize that learning comes with or after doing, and that knowledge can not be separated from the context to which it will be applied. Their argument for integrating learning and doing also exemplifies Wang's belief, and lays out the approach that makes possible the fusion of knowing and action.

MEDIATION OF EMPOWERMENT - METACOGNITION

What is Metacognition?

As stated earlier, Flavell (1978) is the pioneer of research on metacognition. He places emphasis of metamemory on the learner's knowledge about variables related to the person, task, and strategies. Scarr and Zanden (1984) define metacognition as awareness and understanding of one's mental states, abilities, memory, and processes of behavioral regulation. Some researchers simplify the term as mere knowledge about one's thought process or thinking about thinking (Glover, Ronning, & Brunning 1990), while others break it up into several subskills. For example, Brown (1978) emphasize aspects of executive cognition such as planning, monitoring, and revising one's thinking; Gall, Gall, Jacobsen and Bullock (1990) define the components of metacognitive skills as knowing the learning process, selecting appropriate learning strategies and monitoring how one's learning strategy is working. Beyer (1987) elaborates the definition of metacognition by incorporating the ability of planning how to carry out the task and carrying it out, monitoring one's process, adjusting one's actions to the plan, and revising both plan and actions in the process. Paris and Winograd (1990) characterize metacognition as knowledge about cognitive states and abilities that can be shared among individuals. According to them, metacognitive skills include both cognitive and affective

characteristics of thinking.

Function of metacognition

The many definitions of metacognition, however different from one another, can yet be seen as a combination of learning and monitoring strategies (Bonner, 1988). Most researchers have now blended those twin approaches into a definition that emphasizes (a) knowledge about cognitive states and processes and (b) control of executive aspects of metacognition (Borkowski, 1985; Brown et al., 1983; Wellman, 1985; cited from Paris & Winograd, 1990). However, I believe that the core of the concept is the dynamic thinking process--critical and conscious action, which is actually Wang's argument that knowing is doing from the viewpoint of learners. Instead of the proceduralizing of the components of metacognition applied by earlier researchers, I contend that looking at the core of metacognition, focusing on its power, and contemplating how one becomes metacognitive are what educators need to do. The dynamic reflective thinking process exerts influence beyond controlling and directing one's learning strategies. It is a key to one's inner "whole", a compass on the sea. Therefore, instead of teaching students what to learn, teachers should have a full understanding of the complex nature of metacognition in order to guide students how to learn and think.

Metacognitive thinking functions to liberate learners from the rigid and proceduralized instructional environment imposed by the instructors, administrators or the whole school system. It emancipates one's potential, making possible independent, life-long learning. When school reformers claim to create a learning-centered environment in schools and to give more freedom to learners, they should contemplate how to enable learners to use such freedom. Therefore, unlike most people who concentrate on the components of metacognition, I would like to emphasize its process in this paper, recognizing that metacognition is a developmental process, and everyone's metacognitive process is different.

NEW PERSPECTIVES OF METACOGNITIVE THINKING

Reconceptualization of metacognition

Traditionally, metacognition has been treated as the combination of learning strategies and monitoring strategies, or the evaluation and revision of them. While learning strategies, the newly learned in particular, tend to be external to the learners, monitoring, evaluation and revision are learners' exercise of internal mental process on these external, or to-be-acquired, strategies. However, metacognition cannot be studied in isolation from critical thinking or creativity, nor should it be studied separate from drifting thoughts. As Borkowski, Carr, Rellinger and Pressley (1990) contend, metacognition tends to last for short period of time. How it is interfered with by drifting thoughts and how it interacts with other mental activities should be clarified in order to provide practitioners with more illuminative guidance.

Nature of thoughts: While characterizing thinking by cognition and metacognition, Beyer (1987) does not tell us precisely how people really think. Scarr and Zanden (1984) affirm that people think in two distinct ways--directed thinking and nondirected thinking. According to them, directed thinking is a deliberate, purposeful, systematic and logical attempt to reach a specific goal, whereas nondirected thinking consists of a free flow of thoughts through the mind, with no particular goal or plan, and depends more on images. The latter is usually rich in imagery and feelings. Daydreams, fantasies, and reveries are typical examples. People often engage in nondirected thought when they are relaxing or trying to escape from boredom or

worry. This kind of thinking may provide unexpected insights into one's goals and beliefs.

Nature of metacognition: Thoughts are like waves that surge all the time, even when we fall into deep sleep. They are like wild monkeys and horses; the harder you try to tame them, the wilder they become. Without diving into the depths, we will never feel the force with which they drive us. Tomio Hirai (1978) says:

> "The human mind is rarely as calm as an untroubled body of water. At almost all times, ripples or waves of pleasant or unpleasant emotion are disturbing its tranquility. Sometimes, the frequency of these disturbances reaches such a peak that the mind resembles a raging sea in which there is never an ebb tide to bring calm." (p.76)

It is essential that educators identify the existence of drifting thoughts and the everlasting ebb and flow characteristic of the human mind. Unlike those who concentrate their instruction exclusively on metacognitive skills and proceduralize this instruction, I believe the design, instruction and learning of metacognition should incorporate nondirected thinking and creative thinking. The question about whether drifting thoughts interfere with metacognitive thinking, or whether metacognition can potentially impede creative thinking is worth contemplating.

Metacognition and creativity: The essence of metacognitive thinking is more complex than the various versions that have been discussed above. Since metacognitive thinking tends to occur in short fits (Borkowski et al, 1990), when learners first learn to use metacognitive thinking, they are like novice surfers who strive to balance themselves in the irresistible and unpredictable surging currents surrounding them. Their balancing skills have to be developed in the raging surges. Similarly, one's metacognitive thinking has to be developed along with drifting thoughts. Rather than dealing with metacognition as a mental activity separate from others, I would emphasize that we cultivate metacognition not to suppress drifting thought, but to skillfully direct drifting thoughts to metacognition, where creativity can be fostered. However, current literature does not mention how one's metacognition interrelates with creativity.

Although Perkins (1990) argues that there is room for mindfulness and control to play in creative thinking, and that creative thinking can steadily become more metacognitive, changing in character as it does so, he does not take into consideration the relationship between drifting thoughts and directed thoughts. What he proposes is more a matter of integrating the strategic feature of metacognition with creative thinking, namely of extracting the strategies for creative thinking and making them executive and manageable. The complex interplay of the two mental activities are not really investigated.

Metacognition and habitual thinking & acting patterns: Habitual thinking or acting is another variable that competes with the cultivation or development of metacognition. Sometimes, it even plays a more dominant role than drifting thoughts in directing one's thinking and acting. Very often people fail to use metacognition not because they don't know the value of it, but because they are not able to overcome the driving force of their habitual, routinized way of thinking and acting. It is through critical awareness of the dominant role of these thinking and acting patterns that people can rise up from the bondage of these patterns and from the frustration, anxiety or lack of confidence caused by the unsuccessful adoption of new ways of thinking and acting. Then they can extend their visions to a broader spectrum, and the expansion of one's repertoire becomes possible.

Metacognition as critical awareness and conscious action: Although awareness of one's cognitive states was identified as a major component of metacognition (Flavell, 1978; Scarr & Zanden, 1984), the complexity of the concept has not been investigated in the literature of metacognition. At best, it is understood as the knowing of one's mental states, learning process or strategies, behavior regulation, ability or memory. As a matter of fact, there are two types of awareness, internal and external. Internal variables include awareness of personal learning strategies or styles, habitual patterns, abilities, predisposition, and self-efficacy or confidence. External encompasses awareness of to-be-learned metacognitive skills, nature of learning tasks, constituents of learning environment, and perception of differences between self and others in terms of the internal characteristic of awareness. It is important to highlight awareness from the two dimensions and assist learners to understand how their internal processes interact with the external variables in a routinized manner, and how such interaction might be improved in order to cultivate learners' awareness at a more conscious and critical level.

Metacognition and reflection: In order to further understand the nature of metacognition, it is important to distinguish metacognition from reflection. In some way, metacognition and reflection are very similar since both of them involve thinking about one's thinking or doing. Dewey (1933) defined reflective thinking as

> "the kind of thinking that consists in turning a subject over in the mind and giving it serious and consecutive consideration. It involves not simply a sequence of ideas,but a consequence - a consecutive ordering in such a way that each determines the next as its proper outcome, while each outcome in turn leans back on, or refers to, its predecessors." (p.3-4).

As described earlier, the moment-to-moment action required in managing one's learning in a metacognitive activity shares some similarities with reflective thinking. However, rather than a precedent or proactive act embodied in reflective thinking, metacognition requires the present, current thought monitoring, taking the form of momentary and ongoing awareness or mindfulness. It is reasonable to draw the conclusion that when a person is engaged in metacognitive activity, he/she must be reflective. However, when this person reflects upon something, he/she may not necessarily exercise metacognition.

Metacognition as dynamic and spontaneous mental activity: More important, rather than seeing metacognition as a combination of static components, we should be looking into its dynamic interacting process among the external strategies, the internal thought processes in which metacognition is just one, and the interfering unpredictable, continuously waving and drifting thoughts. In other words, instruction and design of metacognition should place as much emphasis on metacognition as on its related thought processes, and be repositioned in a larger learning context.

<u>Developmental processes of metacognition</u>

Given that one's metacognition is developed along with drifting thoughts, and keeping in mind how a novice surfer becomes adept at balancing him/herself in the unexpected surges (as drifted thoughts), I will elaborate in the following section as to how one becomes a person from <u>under</u> and <u>on</u> metacognition, to <u>in</u>, and then <u>of</u> metacognition.

Although most of us use metacognitive thinking in some form or other, we are not necessarily aware of it, because the activity is in our subconsciousness. This is what I call -

under metacognition. When we are under metacognition, drifting thoughts and habitual thinking and acting patterns play very dominant roles in driving our action. We might be metacognitive sometimes, but this appearance is very momentary. Most of the time, our learning strategies are used habitually, lacking a critical reflection of their virtues and vices. Once we come to recognize the existence of metacognition and begin to know the various metacognitive skills, we start the journey to the practice of metacognition, and will be on metacognition. During this stage, strategies play a more explicit role than they do in the previous stage, since most of our attention is directed toward the newly-known strategies. While drifting thoughts and habitual thought patterns are still active, there is more room for the exercise of metacognition. However, our awareness of our own mental states and traits, or use of the newly acquired strategies, and monitoring process are frequently interrupted by various kinds of drifting thoughts. When we enter into metacognition, we are first confined within the framework; metacognitive skills, at the moment, become the focus of our attention. However, we are not able to use them freely although we are taught to or learn to deliberately apply metacognitive skills. While other metacognitive skills, such as critical awareness and reflection are also taking a more active form, these skills are more external than internal. It is not until we can automatize metacognitive thinking that it becomes a natural part of our thinking, and will not impede creativity. Until metacognitive thinking becomes autonomous and used less deliberately, then we will be of metacognition. When we are of metacognition, we will no longer stand inside the circle of ourselves. We can distance ourselves more easily and look into ourselves from a wider angle and more diverse perspectives. Reflection at this stage will become more critical then it is in the previous stages, since the self is elevated from the original lower point. Although drifting thoughts and habitual patterns of acting and thinking might occur sometimes at this stage, we can direct these interfering thoughts, confronting them with more positive attitudes by searching for the rooted problems more clearly, and convert these thoughts into forces of improvement. In general, the process is not linear, but cyclical. Even after we become of metacognition, we might be under metacognition for short moments when our mental states are under great impact.

It is important to identify where a learner stands in this process and provide appropriate instruction accordingly. Because metacognitive development takes time to cultivate, neglecting these stages will result in futile efforts concerning instruction and design. It is also essential to incorporate instruction and design of instruction with such acquisition processes, giving full consideration to the various concepts relevant to metacognition. In other words, the design of metacognitive instruction should be integrative with the learning process, and be compatible with other thinking and acting processes. How one proceeds from novice to expert of metacognition and what roles the reconceptualized components of metacognition play in this process are the important considerations teachers and designers should take into account in order to make instruction rigorous.

PRINCIPLES OF METACOGNITIVE INSTRUCTIONAL DESIGN

Levels of empowerment

Generally speaking, there are several levels of empowerment. For example, empowerment can take place at the personal, interpersonal, organizational, or societal level. No matter which level it might occur, it will definitely influence other levels to a certain extent. Apparently, the developmental process of metacognition seems to belong to the personal psychological level. However, the essence of empowerment through metacognition is to make

changes in one's thinking and ultimately action. When people at each level become more metacognitive, empowerment will simultaneously occur at the various levels, which in turn makes the environment more favorable to the fostering of metacognitive development.

Instructional principles of empowerment

Pluralistic spirit: The first principle of empowering learners through metacognition is that instructional and design must have a pluralistic spirit, since metacognitive thinking differs from one person to another. However, instructional designers have been working in a mode of totality, certainty, and control. Giroux (1988) points out that educational theory has been strongly wedded to the language and assumptions of modernism. Within the discourse of modernism, knowledge draws its boundaries almost exclusively from a European model of culture and civilization. According to Lyotard (1984), postmodernism is a rejection of grand narratives, metaphysical philosophies, and any other form of totalizing thought. The challenge of postmodernism is important for instructional designers because it raises crucial questions regarding certain hegemonic aspects of modernism and, by implication, how these have affected the meaning and dynamics of our practice. In recent years, more and more educational technologists have recognized that the standardization mindset of the industrial age should give way to the diversity mindset of the information age. For example, Benathy (1991) states that the prevailing educational design-which is rooted in the industrial model of the last century-cannot be improved or restructured to meet the requirements of the post-industrial information/ knowledge age. We are called upon to envision new images of education and, based on them, design new systems of learning and human development which will prepare future generations for the challenges of the new era, and empower them to shape their own lives and the life of their society. It is my belief that instructional designers should recognize the plurative reality in the postmodern era and think metacognitively during the design process in order to broaden or even break the boundaries that prevent them from designing creatively.

Such pluralistic spirit will be best presented if instructional designers identify learners' multiple ways of knowing, recognizing the various human beings' intelligences without favoring only some of them (Gardner, 1985). When designing instruction, one of the instructional approaches is multiple ways of teaching. There is no best instructional strategy, but only most appropriate for certain types of learning tasks, ones for certain group of learners, and under certain circumstances. Instructional design should embrace multiplicity, rather than optimality. Taking analogy as an example, a pluralistic way of designing instruction with analogy would not only be multiple analogies for a variety of contexts (Wilson & Cole, 1990), but also analogies that can accommodate the cultures of diverse groups of learners, using the language and social norms familiar to the learners. In other words, analogies should not be formulated at the abstract or conceptual level. Instead, it should be integral with the target learners' culture.

Resolving the boundary: The second principle is resolving the boundary. Instruction and design of metacognition, though they can be initiated or undertaken from the content of metacognition, are not a self-independent activities. The first step for us to resolve the boundary is to unlearn what we have learned because we are often blinded by what we have known, rather than what we don't know. The second is to approach a task from as many angles as possible. For example, metacognition can be regarded from cognitive, affective or behavioral aspects. It can also be studied with creativity, critical thinking, problem solving etc. In the

section of reconceptualization of metacognition, I have demonstrated some of this spirit. Limiting the design or instruction of metacognition simply to the content of metacognition will result in rigidity and inflexibility. This is to see a task ALWAYS as a part of something.

Divergent inquiry: In order to empower learners, inquiry should take divergent forms. Any point could be the best cutting point for instruction and design as long as it leads to the goal. Where the starting point of inquiry should be all depends on the learners' metacognitive stage and level, needs, and most important of all, teachers' (designers) knowledge, personality and capabilities. It is important that instructors or designers identify where they and the learners are standing in the process of metacognitive development, and understand the most difficult metacognitive skills that confront learners or themselves in order to determine the focus of instructional emphasis. It is also essential to explore the dynamics of their and learners' development in the process since metacognition is an ongoing mental activity. Learners should be exploring this collaboratively with instructors, or instructional designers should be looking into this with instructors. Because learners of the same group might be in various stages of metacognition, instructional guidance and support should vary accordingly. Inquiry approach for people under metacognition could be more direct and concrete, whereas for those of metacognition, it could be less strategic.

In addition, inquiry can be an inside-out or outside-in approach or other kinds. For example, an instructional strategy can either direct learners' attention first to his/her own drifting thoughts, examining how they influence their learning, or it can focus on learners' task performance, tracing back to the interfering factors. It can also be inquiry of others, which illuminates understanding of self. Divergent inquiry strategies could ensure both the breadth and depth of multiplicity and reflectivity.

Treasuring mistakes: The essence of empowering learners through metacognition lies in its capability of turning drifting, disturbing and interfering thoughts to positive, guided, generating and even creative thoughts. Therefore, instruction and design of metacognition should value mistakes and misconceptions, and distorted ideologies for they are the sources from which possibilities of change arise. All of these sources should be highly valued and be traced back so that rooted problems can be explored. Teachers or instructional designers tend to value strengths more than weaknesses and correctness more than mistakes in the process of instruction. Many instructional models emphasize how to make the best use of learners' strengths in order to motivate them or enhance their self-confidence and motivation. However, there is no instructional approach that is a cure-all. In many cases, people need to be aware of the internal and external obstacles that inhibit their progress. Instruction and design of metacognition should make these explicit to learners.

Strategy-reflection: For this principle, instructional designers or teachers are not to reflect how well learners have performed through certain strategies. The focus is not the learners' learning achievement, but the instructors or designers themselves. Instructional design is not merely the design of a learning task. It is how designers SEE the to-be-designed task and users/learners. It is embedded in teachers' (designers') knowledge, values, experiences and some hidden ideologies and presumptions. For metacognition is a more abstract concept, which takes one form or another in everyone's mind, the strategy-reflection principle should be directed to reflect the values, assumptions and ideologies that are embedded in the way we teach or design. By doing so, we can be emancipated from our confined limited knowledge of

learning, instruction and design.

CONCLUSION: A REMARK ON DESIGN

In this paper, I have proposed a new perspective for designing metacognition, drawing both upon how human beings acquire metacognitive skills and how these skills are interwoven with other thinking skills. It helps us investigate how the acquisition of metacognitive skills could be coordinated with appropriate approaches to teaching, guiding and enlightening learners about these same skills. An instructional designer should bear the dynamic and integrative nature of metacognition in mind, so that the actuation of learning, instruction and design possibilities can be attained. In other words, the instruction and design of metacognition should be integrated with the nature and development of one's metacognition.

Traditionally, learning theories, instructional theories and instructional design theories are treated as three distinct entities. Numerous arguments about whether instructional theories can stand alone from learning theories have been made. Recent exploration of Constructivism has provided a great deal of insights into the possibilities of integrating the two. Nevertheless, current instructional models of metacognitive thinking do not incorporate the learning process of metacognition. They are procedural-oriented, neglecting the dynamic process and the holistic nature of mental activities because of the problematic definitions and their narrow view of the function of metacognition. Since metacognition is taught without being integrated with other thinking skills, creativity and ease of learning may be often sacrificed.

It is not until learners, teachers and designers all engage in the roles they play that a learning-centered environment becomes possible. Teachers need to play the role of facilitator in order to guide, rather than control students' learning. They should never cease to be learners if they wish to master the art of teaching. Instructional designers, who have taken for granted that their knowledge of instruction exceeds that of teachers, need to reflect on the complex interactions between learning and instruction. More important, learners need to be given the responsibility to direct, manage or even design their own learning. When they become teachers of themselves, they could be more creative. In addition, teachers' metacognition will enable them to perceive their instruction in a more reflective, dynamic way; instructional designers', together with learners' metacognition, will allow them to make better decisions about the kinds of instructional and learning activities appropriate for learners.

The mission of instructional designers is to enable teachers to design instruction metacognitively that will in turn empower students to design learning for themselves. Empower teachers and we empower learners. In a learning-centered environment, instructional designers will be the backstage heroes, assisting learners and teachers to become the main actors of the learning drama.

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